

## **Fibre optic leakage detection system at the pumped storage power plant Waldeck I, Germany**

The early detection and the exact localisation of leaks in hydraulic construction sealings are the basis for reliable and safe structural monitoring. Temperature measurements along fibre optic cables enable the exact localisation of leaks and help to prevent possible damage.



Pumped storage power plant Waldeck I, Germany

For the use of hydropower as renewable energy, the pumped storage plant Waldeck I was put into operation in 2009. If there is an oversupply of electricity, water is pumped from Lake Affolderner into the artificial reservoir on the Peterskopf, which is located at a 300 m higher level. The upper basin can hold 0.7 Mio m<sup>3</sup> of water.

During the renovation of the upper basin, the waterside retaining wall was sealed with PVC geomembranes. A fibre optic leakage detection system was installed for the purpose of monitoring. This reliable and cost-effective monitoring system is based on the principle of distributed temperature measurement within a fibre optic cable. Roughly 1700 m of hybrid cable was used in order to distinguish and to locate leaks in the wall area of the sealing membrane and in the connection to existing asphalt concrete (basin bottom). The leakage detection system has a local resolution of  $\pm 0.5$  m and a temperature resolution of  $\pm 0.2$  K.



Installation of the fibre optic cable along the geomembrane

The hybrid cable allows temperature measurements and the application of the Heat-Pulse-Method with an electrical conductor. Thereby, a temperature increase and the thermal conductivity can be calculated. Thus, significant temperature anomalies can be detected and interpreted. Possible defects in the sealing membrane can be located with an accuracy of  $\pm 0.5$  m.

A temperature measurement during full impoundment of the pumped storage plant serves as a reference measurement in order to quickly locate future changes in the sealing system of the upper basin.